

Round Rock ISD – 2008-09

Lesson 2 – Grade 3 Measurement Kit

Metric Benchmarks and Relationships* - A Length Measurement Lesson

*Lesson is adapted from two activities in *Sizing Up Measurement: Activities for Grades 3-5 Classrooms*, by Chris Confer, Math Solutions Publications, 2007.

Mathematics, Grade 3

Materials:

- **Student Page:** “Metric Benchmarks Recording Sheet,” 1 per student
- **Decimeter Rod**, 10 per pair of students (use 1 per student in first activity), printed on cardstock or transparency plastic, already cut out from a copy of the attached black line master of numberless centimeter rulers. Cut out 10-cm-long rods from the page of numberless cm rulers. You can also find this black line master at:
http://www.vendian.org/mncharity/dir3/paper_rulers/UnstableURL/rules_cm_numberfree.pdf
(Make sure printer setting is set to “no scaling” rather than “fit to page,” etc., so that rulers will print out as accurate centimeter scales.)
- centimeter cubes, 10 per pair of students (use 1 per student in first activity)
- meter sticks, 1 per group of 4
- chart paper, 2 sheets
- markers

TEKS/SEs:

- 3.11 – directly compare the attribute of length, and use comparative language to solve problems and answer questions; select and use standard units to describe length
- 3.11A– use linear measurement tools to estimate and measure lengths using standard units
- 3.2A – construct concrete models of fractions
- 3.2B – compare fractional parts of whole objects or sets of objects in a problem situation using concrete models
- 3.2C – use fraction names and symbols to describe fractional parts of whole objects or sets of objects

Objective 6 TEKS/SEs (Underlying Processes and Mathematical Tools):

- 3.14A – identify the mathematics in everyday situations
- 3.14B – solve problems that incorporate understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness
- 3.14D – use tools such as real objects, manipulatives, and technology to solve problems
- 3.15A – explain and record observations using objects, words, pictures, numbers, and technology
- 3.15B – relate informal language to mathematical language and symbols
- 3.16A – make generalizations from patterns or sets of examples and nonexamples
- 3.16B – justify why an answer is reasonable and explain the solution process

Lesson objective(s):

- Students explore, in a problem-solving situation, a length measurement problem involving the size and relationships of metric units of length.
- Students identify mental images, or benchmarks, and use them to recall the meaning of metric units.
- Students estimate lengths and measure using metric linear measurement tools.
- Students compare and find relationships between metric units of length.
- Students explain their solution strategies and justify their solutions.
- Students record their solution methods using words, pictures, tables, numbers and symbols

Differentiation strategies to meet diverse learner needs:

- Problem- solving, inquiry-approach
- Hands-on exploration
- Collaboration and discussion

Round Rock ISD – 2008-09

Lesson 2 – Grade 3 Measurement Kit

Vocabulary:

- benchmark, centimeter, centimeter cube, decimeter, decimeter rod, distance, equal, hundreds place, length, longer, meter, meter stick, metric system, millimeter, place value, powers of ten, relationships, ruler, shorter, tens place, units

ENGAGEMENT

- Explain to students that today they are going to learn about something that will help them remember sizes of units that measure length. They are going to learn about “benchmarks,” which are “pictures in their heads” or ways to remember how long different units are.
- When they hear a word such as “centimeter,” they will imagine something that is the same size, such as the width of their fingernail.
- Ask students to share their benchmarks for an inch. What do they think of when they think of the size of an inch? Students may think of the length of their thumb from the knuckle to the tip, the length of a small paper clip, the diameter of a quarter, etc.
- Today students will be choosing benchmarks that can help them remember the length of different metric units such as centimeters and meters.

EXPLORATION

Part 1:

- Show students a centimeter cube and explain that each dimension (length, width, and height) of the cube is one centimeter. Write *centimeter* on the board. Demonstrate how to measure one centimeter of length using the cm cube.
- Provide each student with one centimeter cube. Ask them to find something easy to measure on their body that is about a centimeter in length, such as the width of their fingernail.
- Provide students with the “**Metric Benchmarks Recording Sheet.**” Ask students to find as many things as they can in the classroom or on their body that are about a centimeter long. Explain that they are to make a sketch of the item and write its name in the section labeled “Centimeter.”
- Tape chart paper to board; leave space at top for title. Divide chart into three sections and label the first one “Centimeter.”
- Bring students together for a class discussion and have them share the items that they have recorded. List several of the examples on the chart paper.
- Ask each student to find one item on her or her list that he or she wants to use as a personal benchmark. Remind students that this benchmark is the item that should pop into their mind when they hear the word *centimeter*. Ask students to draw a star next to the item they have selected as their personal benchmark.

Part 2:

- Repeat the investigation in Part 1 above, except use the numberless **Decimeter Rod** (see Materials list above).
- Add information to the class chart as above in Part 1, except label the second section “Decimeter.”

Part 3:

- Repeat the investigation in Part 1 again, except this time use meter sticks.
- Add information to the class chart as in Parts 1 and 2, except label the third section “Meter.”

Part 4:

- Tell students that centimeters, decimeters, and meters are all units in the metric system, which is a measurement system that is used all over the world. It is also the system that is used in science classes. Write the title “The Metric System” on the class chart.
- Have students explain how each of the names of the three units on the chart are alike. As they explain, underline the root word “meter” in each of the unit names. Mention that *centimeter* means one-hundredth of a meter, and that *decimeter* means one-tenth of a meter. Tell students that they will explore the relationship between these units in the next measurement lesson. (See activity in Elaboration below.)

Round Rock ISD – 2008-09

Lesson 2 – Grade 3 Measurement Kit

BASIC UNDERSTANDINGS (from activities in Exploration above and Elaboration below):

- Length is the distance between two points. Informally, it is how long, tall, far around, far away, etc., something is.
- There are no gaps or overlaps when measuring length.
- Length can be estimated by using benchmarks, or familiar items that are the length of standard units. Benchmarks can also be used to determine the reasonableness of measurements.
- Conversions can be made between smaller and larger units of length.
- One centimeter is the same as 10 millimeters.
- One decimeter is the same as 10 centimeters.
- One meter is the same as 10 decimeters.
- One meter is the same as 100 centimeters.
- Metric units relate to each other in the same way that units in place value relate to each other: powers of ten.

EXPLANATION

- Students will explain their thinking and justify their solutions in groups and in whole-class discussion, as well as with tables, diagrams, and written explanations. See activities in “Exploration,” “Elaboration,” and “Evaluation.”

ELABORATION – Relationships in the Metric System

Part 1:

- Title a piece of chart paper “Metric Relationships” and post the chart paper on the board. Discuss the meaning of the word *relationships*. Talk about how we are related or connected to people in our families. Explain that a person can be related to different people in different ways. For example, I am a daughter to my parents, a sister to my brothers, a wife to my husband, and a mother to my children. I am also an aunt, a mother-in-law, a daughter-in-law, a sister-in-law, a cousin, a grandmother, and a niece. In the same way, a centimeter has many different relationships to other units of measure.
- Provide students with 10 centimeter cubes and 10 **Decimeter Rods** (see Materials list above for directions for creating the **Decimeter Rods**). Hold up a centimeter cube and a decimeter rod. Ask students to turn and talk to a partner about how those two units of measure, or lengths, are related. Have the students share some of their statements with the class. If the class agrees with their statement, write it on the chart. For example, one statement might be: “There are 10 centimeters in 1 decimeter.” Ask a student to sketch that relationship on the board. Ask students to give you an example of that relationship, such as how many centimeters are in 2 decimeters. Add all the statements and relationships to the chart.
- Ask students to describe the relationship in terms of fractions. Ask: What fractional part of a decimeter is a centimeter? Demonstrate by placing a centimeter cube on top of a decimeter rod. Have partners discuss, and then share and record on chart: “A centimeter is one-tenth of a decimeter.” Again, ask for examples of this relationship. What fraction of a decimeter is 2 centimeters? (two-tenths) A more difficult question is: What fraction of two decimeters is 1 centimeter? (one-twentieth) Help students work together to find these relationships using their centimeter cubes and decimeter rods.

Part 2:

- Ask students to show you on the decimeter rods the lengths of: a decimeter; a centimeter; a millimeter. Show students a meter stick, and explain that it is a meter. All of these are metric units, and they are the four units that students will be investigating.
- Explain to students that they are going to work in pairs to find as many relationships as possible to describe how metric units – meters, decimeters, centimeters, and millimeters – relate to each other. Tell students that they are to explain the relationship in writing and include pictures and examples of how those relationships work, like we did in the discussions (above).

Round Rock ISD – 2008-09
Lesson 2 – Grade 3 Measurement Kit

- Provide pairs with meter sticks (they may share these with another pair) and the “**Metric Benchmarks Recording Sheet.**” Circulate among the groups to offer support, scaffolding questions, and clarifying questions. Also ask: “Do you both agree that this statement is true?” and “How can you prove it?”
- Encourage students to consider relationships in terms of multiples and in terms of fractions. Remind students to include examples of the relationships and to express the relationships in complete sentences.

Part 3:

- Bring students together for a class discussion and have the pairs share what they have discovered. Discuss the relationship between centimeters and decimeters, always having students justify their statement and seeing if the class agrees. If so, post the statement on the chart. If not, have class help revise the statement.
- Continue the discussion with decimeters and meters, centimeters and meters, and millimeters and centimeters.
- Summarize some of the big ideas from the chart. Point out that centimeters are ten times as large as millimeters; that decimeters are ten times as large as centimeters, and that meters are ten times as large as decimeters. Compare these relationships with those in place value. (Ten’s place is ten times as large as the one’s place; Hundred’s place is ten times as large as the tens place; and so on.)
- Discuss the prefixes *centi-*, and *deci-*. Write them on the board. What words come to mind? Students may suggest cents, century (100 cents in a dollar; 100 years in a century), and dime and decade (10 dimes in a dollar, 10 years in a decade). Students familiar with Spanish may be able to connect *centi-* with *cien* and *ciento* (one hundred); *deci-* with *diez* (ten); and *milli-* with *mil* (one thousand). Point out connections with statements on the chart: There are 100 centimeters in a meter; there are 10 decimeters in a meter; there are 1000 millimeters in a meter. Record the connections between the prefixes and Spanish words if appropriate.
- Post the chart on the wall and encourage students to refer to it when they use metric units.

EVALUATION

- Do students use accurate and efficient measuring strategies?
- Do students understand that when measuring using a ruler, they are counting the spaces between the numbers?
- Are they avoiding gaps and overlaps when measuring length?
- Do students make reasonable estimates/predictions? On what do they base their estimates/predictions?
- Do students have a benchmark for how long a centimeter is? decimeter? meter? Are they able to use benchmarks to make reasonable estimates?
- Are students able to determine the reasonableness of their solutions and the solutions of others?
- Do students understand the relationships between millimeters and centimeters and between centimeters and meters?
- Do students understand that the relationships in the metric system are based on powers of ten in a way similar to our numeric place value system?

Metric Benchmarks Recording Sheet

Centimeter

Decimeter

Meter

Round Rock ISD – 2008-09
Lesson 2 – Grade 3 Measurement Kit



